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ABSTRACT

Secondary school students who drop out of school are put at great social and economic disadvantage. If potential dropouts can be identified early, prevention may be possible. To construct a prediction model which, through readily available school information, will aid in the identification of students likely to drop out, schools in the Austin, Texas, school district provided data on students sampled according to birthdate (N=5,039). The longitudinal study encompassed four school years (1977-1981), and students were classified into four groups: non-leavers, transfers, dropouts, and other/unknown. The variables studied were gradepoint average (GPA), grade placement, sex, ethnicity, and number of serious discipline problems. Statistical analyses showed that students who had low GPA's, were behind in grade for their age, had been involved in serious discipline incidents, were female, and were non-black had a higher than average probability of dropping out. Most of these variables had face validity for predicting dropping out. Two findings were somewhat misleading: in fact, girls as a group had a lower drop out rate than boys; however, an individual girl with certain characteristics might be more likely than a similar boy to drop out. Although scores of Blacks on variables were similar to scores of Hispanics, Blacks were less likely to drop out, apparently due to influences outside of the variables scored. Altogether, about 78% of dropouts and non-leavers were correctly classified. (WAS)

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DROPOUT PREDICTION

AERA Convention Presentation

Montreal, Canada

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DROPOUT PREDICTION

Objective:
The objective of the study was to construct a prediction model that aids in the identification of secondary students likely to drop out of school from readily available school information.

Educational Importance:
If potential dropouts can be identified early, prevention may be possible.
A substantial portion of our students drop out of school. Such students are put at great social and economic disadvantage. In addition to the loss of school experience and skills, they are much less likely to find employment than graduates. In 1970, 48.3% of Austin male dropouts 16-21 years of age were unemployed. Only 18.4% of the same-age high school graduates, who were not continuing their education, were unemployed. (US Census Bureau)

Data from Austin's latest study (Doss, 1982) indicate a disproportionately high number of Hispanics drop out of school. Thus, while dropout prevention programs are probably in order, these programs must also address any special needs of the Hispanic students.

Review of the Literature:
A review of the literature was conducted to:

- identify variables with predictive potential
- examine methodology

Variables With Predictive Potential

In reviewing the research literature, twenty-four variables that are related to dropping out were identified. Table I summarizes the findings. It is obvious that some of these variables are likely to be readily available to a school district while others are much less likely to exist on a regularly maintained file. Differences in data collection and data management among school districts will assure a variabilility in the types of data readily available. However, it is likely that a core of information will be common among nearly all districts. Grade point average, average number of credits, ethnicity, achievement scores, and below grade placement are likely to be accessible from files already existing in the district. On the other hand, family history of dropping out, mother's and father's education, feelings toward authority, peer status, etc. most likely are not available without additional costly data collection efforts.

Our interest was in developing a statistical model that would not only identify potential dropouts accurately but that would be practical, i.e., no additional data need be collected.

As such, the variables accessible to our model included only:

Grade point average
Grade placement (grade in which student was enrolled)
Sex
Ethnicity
Number of serious discipline problems

TABLE I

VARIABLES RELATED TO DROPPING OUT

		SOURCES: Degracie, etal., 1976	Delaney & Tovian	Dudley, 1971	St. Illinois, 1962	Johnson & Hopkins, 1972	Philadelphia, 1977	Rhode Island, 1977	Rumberger, 1981	Watson, 1976	Young & Reich, 1974	TOTAL
1.	Below grade placement/# grade retentions/age			✓	✓						✓	3
2.	Average number of credits										✓	1
3.	Lower family incomes								✓		✓	2
4.	Ethnicity	✓					✓	✓	✓	✓	✓	6
5.	IQ/Mental measurement scores				✓	✓						2
6.	Grade point average		✓	✓	✓	✓						4
7.	Achievement scores	✓			✓							2
8.	Extra curricular participation				✓							1
9.	Absenteeism		✓		✓	✓						3
10.	Peer status				✓							1
11.	Father's occupation			✓	✓							2
12.	Teacher ratings/prediction of dropping out					✓						1
13.	S feelings toward authority					✓						1
14.	Assumption of academic response					✓						1
15.	Mother's education			✓					✓			2
16.	# siblings		✓						✓			2
17.	Detentions		✓									1
18.	Father in the home	✓										1
19.	Father's education								✓			1
20.	Family had resided outside the U.S.								✓			1
21.	Educational aspirations								✓			1
22.	Marriage or child bearing before graduating								✓			1
23.	Best friend's educational aspiration								✓			1
24.	Family history								✓			1

Methodology Considerations

From a review of the literature, two major methodological flaws were identified that would tend to lessen the discriminating power of the prediction models.

- Many studies have attempted to discriminate dropouts from graduates within a group already selected by school authorities as being at risk for dropping out. This results in a restriction of range in variance problem. (Johnson, 1972; Delaney, 1972)

- Several studies have attempted to predict dropping out over a relatively short period of time--the nine-month academic year. This results in several misclassifications if the purpose is to predict long-term dropouts. (Degracie, 1974)

To alleviate those problems, the Austin study was longitudinal encompassing four school years, 1977-78, 1978-79, 1979-80, and 1980-81, and school leavers were classified into four basic groups:

- Those remaining in the Austin schools, "Nonleavers" (69.5%)

- Transfers (11.9%)

- Dropouts (11.7%)

- Other and unknown (6.9%)

All students enrolled in the regular Austin schools during the 1978-79 year who had birthdays between 9/2/63 and 9/1/64 were included in the data file for this study (N=5,039). Of these students 68% were on grade level (9th grade), 25% were below grade level, and 7% were above grade level.

Enrollment data for each year from 1978-79 until the fall of 1983 was collected from the district Master Student File. Test scores, special education status, and other variables were collected from other files. Students who entered the District in subsequent years were not added to the file.

Students who left the District and never returned were identified as "school leavers." Their records were checked in the schools in order to determine which ones were likely to be dropouts. Following the record checks, students were classified into three groups: nonleavers, dropouts, and other leavers (included transfers). Nonleavers were students who graduated or who were still enrolled in the fall of 1983. Dropouts were students for whom we could find no evidence that they transferred to another diploma-granting institution. Other leavers included those who transferred to another school district, who became associated with an organization that might grant a high school diploma such as the armed services or the state prison system, or students for whom we could find no permanent record card.

Discriminant analysis was used to determine how well dropping out could be predicted from readily available information in the District computer files. The students included in the analyses were limited to nonleavers and dropouts. The variables chosen for the analysis were those available at the beginning of the 1978-79 school year (the year they should have entered ninth grade): sex, eth-

nicity, grade point average, and the number of serious discipline incidents (e.g., corporal punishment, suspension, etc.) in which the student had been involved during the preceeding year. Ethnicity was entered as three binary variables--

Hispanic: 1 if Hispanic; 0, otherwise.
Black: 1 if Black; 0, otherwise.
Other: 1 if other than Hispanic or Black; 0, if Hispanic or Black

The analyses were run using the SPSS DISCRIMINANT program on the University of Texas CDC Dual Cyber system. A stepwise discriminant analysis procedure was used with the order of entry determined by the variable which would give the largest Mahalanobis distance between the two groups. Special education students were omitted from the analyses because their grade and GPA values were probably different in meaning from those of the other students.

In order to check the stability of the classification resulting from applying the discriminant function, a second analysis was done using the variable identified in the original analysis but only a 60% random sample of the students. The new weights were determined using the direct method. They were then applied to the classification of the remaining 40% of the sample.

Information was available on a few variables not included in the discriminant analysis. These variables were LEP (limited English proficiency) status and reading and math achievement scores. They were omitted from the discriminant analysis for several reasons. LEP status was omitted because there was some question of the validity of the designation for the year 1978-79 and because the number of LEP students was so small compared with the number of non-LEP students. The achievement scores were omitted because the students in the analysis were found at both junior high and high school. Different tests were given at those grade spans, and no reasonable way was found to equate the tests. Therefore, the dropouts and nondropouts were compared on these variables after the discriminant analysis to determine how the groups differed on them.

Results

The data file contained records on 5,039 students. A total of 4,752 were included in the discriminant analyses after special education students were removed. Figure 1 shows their drop status as of the fall of 1982. These students are of the age so that they should have graduated in May, 1982.

Figure 2 shows the dropout rate for the students by sex and ethnicity. Note that transfer students and "other leavers" were removed from the analyses when the percentage dropping out was calculated. The percentages reported in the table are the proportion each group represents in the population about which a dropout-nondropout distinction could be made. The results show that the dropout rate for males was slightly higher than for females. Hispanic students had the highest dropout rate followed by Blacks then Anglo/Others. Within ethnicity, males had a higher dropout rate than females with the exception of Anglos/Others where the reverse was true. The dropout rate for Hispanics is about twice the rate for Anglo/Others.

Figure 3 presents the number and percentage of students who dropped out during the regular school year or during the summer (i.e., they did not return to school the following year). These results show that students who complete a school year are likely to come back the following fall if only for a short time.

Status	Number	Percent
Graduated	2,438	48%
Transferred	745	15%
Still Enrolled	527	10%
Dropped Out	942	19%
Other Leavers	387	8%
Total	5,039	100%

Figure 1: STATUS OF STUDENTS INCLUDED IN STUDY AS OF FALL, 1982.

	DROPOUTS		
Group	N	Percent	Total
Hispanic	335	35%	947
Males	180	38%	478
Females	155	33%	469
Black	186	28%	670
Males	97	29%	329
Females	89	26%	341
Anglo and Other	421	18%	2,282
Males	216	18%	1,176
Females	205	19%	1,106
Total Males	493	25%	1,983
Total Females	449	23%	1,916
Total	942	24%	3,899

Figure 2: DROPOUT RATE BY SEX AND ETHNICITY
Excludes transfer and other leavers

Year	Age	School Year N	School Year %	Summer N	Summer %	Total N	Total %
78-79	14-15	94	10%	54	6%	148	16%
79-80	15-16	117	12%	47	5%	164	17%
80-81	16-17	197	21%	66	7%	263	28%
81-82	17-18	233	25%	75	8%	308	33%
82-83	18-19	59	6%	--	--	59	6%
Total		700	74%	242	26%	942	100

Figure 3: NUMBER AND PERCENTAGE OF DROPOUTS BY TIME OF DROPPING OUT "School year" students attended school for part of the school year. "Summer" students completed school year but did not return.

STEP	Variable	Wilk's Lambda	Sig.	Minimum D Squared	Sig.
1	GPA	.770048	.0000	1.77643	.0000
2	GRADE	.752187	.0000	1.95986	.0000
3	BLACK	.744401	.0000	2.04259	.0000
4	DISCIPLINE	.741555	.0000	2.07326	.0000
5	SEX	.738575	.0000	2.10562	.0000

Figure 4: DISCRIMINANT ANALYSIS SUMMARY TABLE

Variable	Standardized Coefficients	Unstandardized Coefficients
GPA	.85091	.1218994
GRADE	.31738	.6176198
BLACK	.23898	.6323207
DISCIPLINE	-.13395	-.1515758
SEX	-.12593	-.1259375
CONSTANT	-	-15.54711

Figure 5: STANDARDIZED AND UNSTANDARDIZED CANONICAL DISCRIMINANT FUNCTION COEFFICIENTS

From a stepwise discriminant analysis five variables were identified that contributed to discrimination between the groups--grade point average, grade, the variable for Black ethnicity, the number of discipline incidents, and sex. The overall canonical correlation was .51. Figure 4 shows the order in which the variables entered the equation. The standardized canonical discriminant function coefficients are displayed in Figure 5. The only variables not to enter the formula were the Hispanic and Anglo/Other binary ethnicity variables. Had one of these variables entered the analysis, the other would have been redundant.

Figure 6 provides descriptive information comparing dropouts, nonleavers, and others. Figure 7 provides descriptive information for all students by ethnicity. Figure 8 provides the probability of dropping out by ethnicity within sex category.

Discussion

What can we learn from the discriminant analysis? The results showed that students who have low GPA's, who are behind in grade for their age, who have been involved in serious discipline incidents, who are female, and who are non-Black have a higher than average probability of dropping out. An examination of Figure 6 and 8 indicates that most of these variables have face validity for predicting dropping out. The GPA of dropouts is lower than that of students who stay in school. Similarly, the percentage below the 9th grade is three times as high for dropouts as for nonleavers. The average number of serious discipline incidents is five times as high for dropouts.

However, two findings appear puzzling at first glance. One finding that appears to be counter intuitive is that girls are more likely to drop out than boys. Figure 8 shows that the dropout rate for girls is lower than that of boys. However, what the equation says is that "all things begin equal," girls are more likely to drop out than boys. But all things are not equal. Girls do not appear to be retained as often as boys, they may have higher GPA's than boys, and they are involved in fewer discipline incidents. Therefore, even if an individual girl tends to drop out more readily than a similar boy, as a group they drop cut less frequently than boys. Furthermore, the variables included in the formula are very limited in scope. The emergence of sex as a predictor indicates that some variables outside the scope of the formula affect girls more negatively than boys. It seems likely that pregnancy would be one of those variables.

The way that ethnicity entered the formula is also surprising. What the formula says is that "all things being equal," Blacks are less likely to drop out than Hispanics or Anglo/Others who are equally likely to leave school. An examination of Figure 7 shows that generally the Hispanic students have mean scores on the variables used in the equation that are very similar to those of Blacks (except on the number of discipline incidents). One might expect the percentage dropping out to be similar for the two groups. However, there apparently are some influences operating that tend to keep Black students in school when similar Hispanic and Anglo/Other students drop out. Those influences appear in the formula as the positive weight on the variable for Black ethnicity. One factor that may be important in producing this positive influence is participation in extracurricular activities. A recent evaluation in AISD (Berrier and Carsrud, 1981) showed that the percentage of Black high school students participating in extracurricular activities was greater than the percentage of Hispanic students.

Variable	Dropouts N=942	Graduates & Stay-Ins N=2,965	Others Unknown N=1,132
Sex			
% Male	52.3	50.4	51.1
% Female	47.7	49.6	48.9
Ethnicity			
% Hispanic	35.6	20.6	18.0
% Black	19.7	16.4	12.1
% Anglo/Other	44.7	63.0	69.9
Grade in 1978-79			
% Below 9th	45.3	15.2	34.9
% at 9th	53.1	75.5	58.7
% Above 9th	1.6	9.3	6.4
% Special Education	6.8	5.3	5.8
Average 1977-78 GPA	76.6	85.8	80.4
% in the range 60-69.9	19.8	1.5	14.0
% in the range 70-79.9	47.1	18.9	30.1
% in the range 80-89.9	28.7	47.5	40.9
% in the range 90-99.0	4.4	32.1	15.0
Average # of Serious Discipline Incidents	0.5	0.1	0.4
Range	0-15	0-10	0-15
Mean Achm't-Spring '78			
CAT Reading ADSS	465.7 (N=616)	542.8 (N=2,219)	521.2 (N=608)
CAT Math ADSS	458.7 (N=617)	545.9 (N=2,219)	513.0 (N=605)
STEP Reading Scale Score	449.1 (N= 19)	461.0 (N= 239)	455.9 (N= 59)
STEP Math Scale Score	442.2 (N= 19)	448.0 (N= 241)	443.1 (N= 58)
CAT Reading %ile*	26	58	49
CAT Math %ile	26	60	47
STEP Reading %ile**	25	76	57
STEP Math %ile	42	71	48
LEP Status			
Number LEP***	15	18	9
NON-LEP	742	2,561	807

* Level 4 equivalent--middle of grade 8
** Spring of 9th grade norms
***LEP includes those not LEP at parent request. NON-LEP includes those exited from LEP status.

Figure 6: COMPARISON OF DROPOUTS, STAY-INS, AND OTHERS ON SEVERAL VARIABLES

Variable	Black			Hispanic			Anglo/Other		
	N	Mean	SD	N	Mean	SD	N	Mean	SD
GPA	596	79.02	7.72	877	80.31	7.90	2,218	86.05	7.47
Grade	715	8.65	.70	1,080	8.62	.66	2,957	8.92	.57
Sex									
Male	325	-	-	519	-	-	1,502	-	-
Female	390	-	-	561	-	-	1,455	-	-
Discipline Incidents	715	.75	1.90	1,080	.24	.88	2,957	.08	.51
Achievement									
CAT Reading ADSS*	504	453.4	74.5	820	462.4	80.5	2,005	574.5	84.6
CAT Math ADSS*	515	455.1	75.7	818	466.0	80.2	1,995	572.6	94.2
STEP Reading Scale Score**	48	449.8	13.5	22	447.9	16.4	242	462.8	13.4
STEP Math Concepts** Scale Score	49	436.7	11.5	22	436.0	12.5	242	450.3	13.4

*Administered to students in proper grade for age or lower.
**Administered to students in advanced grade for age.

Figure 7. MEAN AND STANDARD DEVIATION OF VARIABLES ENTERING DISCRIMINANT ANALYSIS AND ACHIEVEMENT SCORES BY ETHNICITY

Group	Total N	Dropouts N	Dropouts %
Males	1,983	493	25%
Below Grade Level	532	239	45%
Hispanics	191	102	53%
Blacks	141	55	39%
Anglos/Others	200	82	41%
On Grade Level	1,341	249	19%
Hispanics	280	78	28%
Blacks	172	41	24%
Anglos/Others	889	130	15%
Above Grade Level	110	5	5%
Hispanics	7	0	0%
Blacks	16	1	6%
Anglos/Others	87	4	5%
Females	1,916	449	23%
Below Grade Level	344	188	55%
Hispanics	136	78	57%
Blacks	102	57	56%
Anglos/Others	106	53	50%
On Grade Level	1,393	251	18%
Hispanics	313	76	24%
Blacks	210	32	15%
Anglos/Others	870	143	16%
Above Grade Level	179	10	6%
Hispanics	20	1	5%
Blacks	29	0	0%
Anglos/Others	130	9	7%
All Below Grade Level	876	427	49%
All On Grade Level	2,734	500	18%
All Above Grade Level	289	15	5%

Figure 8: DROPOUT RATES BY SEX, ETHNICITY, AND GRADE RELATIVE TO AGE IN 1978-79.
Students below grade level were in grade 8 or lower in 1978-79. Students above grade level were in grade 10 or higher.

In summary, it would appear then that the differences in dropout rates between Blacks and Hispanics result from the positive influences which keep Black students in school. The difference in rates for Hispanics and Anglo/Others results from the frequency with which the two groups are represented in the low achieving group of students. The difference in dropout rates between Blacks and Anglo/Others results from a combination of the difference in mean values on the salient variables and the positive influences on Black students.

Another way to look at the differences between groups is to compute a discriminant function value for each group using the unstandardized weights in Figure 5 and the mean values found in Figure 7. The results are reported in Figure 9. In doing the calculations, a value of 1 was used for a male, a 3 for a female (the values coded in the file). For example, the value on the discriminant function for the average Black male would be computed by summing the following products:

Constant	=	-15.54711
GPA	=	79.02 x .1218994
Grade	=	8.65 x .6176198
Black	=	1 x .6323207
Discipline	=	1 x-.1515758
Sex	=	1 x-.1259375

The results in Figure 8 illustrate the more than one-half standard deviation advantage Black students have over similar Hispanic students.

One caution to be observed in interpreting the results of the discriminant analyses should be mentioned. The descriptive information presented in Figure 6 reveals some difference in the number of males and females for Blacks and Hispanics. That is, Black males represent only about 45% of the population and Hispanic males represent only about 48% when the expected percentages would be very close to 50%. It may be that some students dropped out before age 14. These findings emphasize the fact that the discriminant analysis applies to predicting dropping out for students still in school at age 14.

How well can we identify those likely to drop out using the discriminant analysis?

As part of the analysis, the resulting discriminant function was used to classify the students in the file. The classification assigned by the formula was then compared to the actual dropout status of the students. The results are reported in Figure 10. About 70% of the dropouts were successfully identified as were about 80% of the nonleavers. Altogether about 78% were correctly classified. In order to get some idea of the stability of the prediction, a second analysis was done. The variables identified as significant in the original analysis were placed in a second analysis using a 60% random sample of the students in the file. New weights were generated using the direct method. Then they were applied to the remaining 40%. The results are reported in Figure 11. Note that the formula developed on only 60% of the sample correctly identified the drop status of over 75% of the remaining 40%.

Two major implications appear evident from this study. The **first** is that **students at risk for dropping out can be identified with reasonable accuracy from**

Discriminant Function Value
Computed At Mean Value For Ethnicity

Group	
Black Males	-.179509
Black Females	-.431384
Hispanic Males	-.595803
Hispanic Females	-.847678
Anglo/Other Males	.313439
Anglo/Other Females	.061564

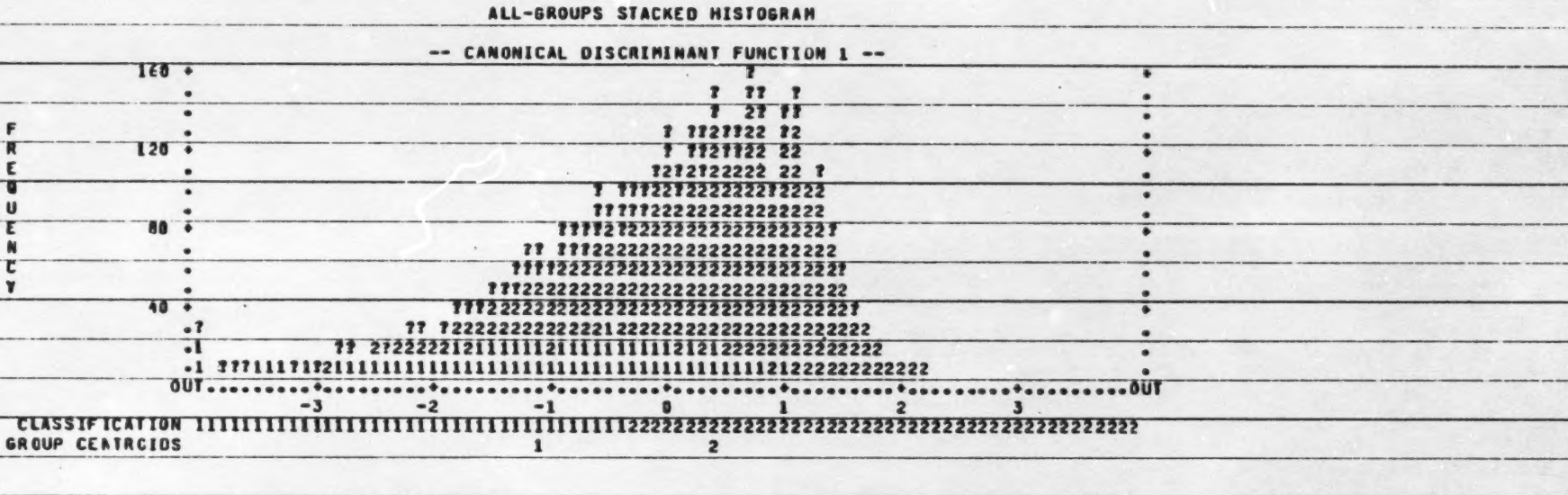
Figure 9: DISCRIMINANT FUNCTION VALUES FOR EACH ETHNICITY BY SEX
Values are computed using the mean value for the ethnicity on GPA, grade, and disciptive incidents. Values of 1 and 3 were used for male and female respectively.

SYMBOLS USED IN PLOTS

SYMBOL	GROUP	LABEL
1	8	DROP OUT
2	5	STAY IN
*		ALL UNGROUPED CASES

ALL-GROUPS STACKED HISTOGRAM

-- CANONICAL DISCRIMINANT FUNCTION 1 --



CLASSIFICATION RESULTS -

ACTUAL GROUP	NO. OF CASES	PREDICTED GROUP MEMBERSHIP Drop Out #	STAY IN #
GROUP 8	649	453	196
DROP OUT		69.8	30.2
GROUP 9	2389	485	1904
STAY IN		20.3	79.7
UNGROUPED CASES	653	326	327
		49.9	50.1

PERCENT OF GROUPED CASES CORRECTLY CLASSIFIED - 77.58

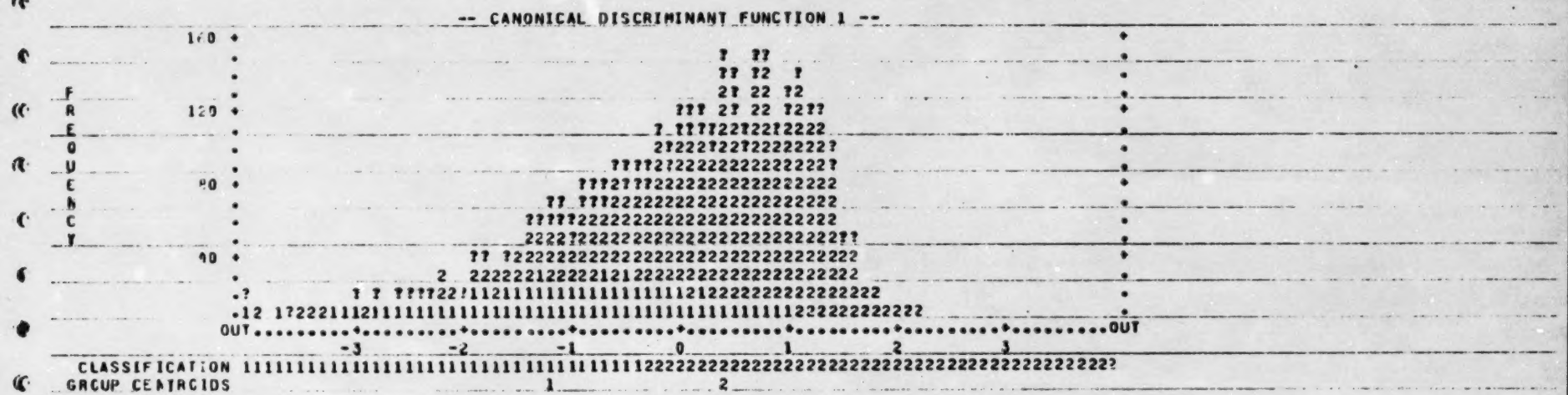
Figure 10: DISCRIMINANT FUNCTION CLASSIFICATION FOR ALL NON-SPECIAL EDUCATION STUDENTS WHO HAVE COMPLETE DATA

SYMBOLS USED IN PLOTS

SYMBOL	GROUP	LABEL
1	8	DROP OUT
2	9	STAY IN
*		ALL UNGROUPED CASES

ALL-GROUPS STACKED HISTOGRAM

-- CANONICAL DISCRIMINANT FUNCTION 1 --



CLASSIFICATION RESULTS FOR CASES SELECTED FOR USE IN THE ANALYSIS

ACTUAL GROUP		NO. OF CASES	PREDICTED GROUP MEMBERSHIP DROP OUT 8	STAY IN 9
GROUP	8	385	282	103
DROP OUT			73.2	26.8
GROUP	9	1404	278	1126
STAY IN			19.8	80.2
UNGROUPED CASES		405	198	207
			48.9	51.1

PERCENT OF GROUPED CASES CORRECTLY CLASSIFIED - 78.70

CLASSIFICATION RESULTS FOR CASES NOT SELECTED FOR USE IN THE ANALYSIS

ACTUAL GROUP		NO. OF CASES	PREDICTED GROUP MEMBERSHIP 8	9
GROUP	8	264	170	94
DROP OUT			64.4	35.6
GROUP	9	985	199	786
STAY IN			20.2	79.8
UNGROUPED CASES		248	121	127
			48.8	51.2

PERCENT OF GROUPED CASES CORRECTLY CLASSIFIED - 76.54

Figure 11: DISCRIMINANT FUNCTION CLASSIFICATION RESULTS USING WEIGHTS DERIVED ON A SAMPLE OF 60% OF NON-SPECIAL EDUCATION STUDENTS WITH COMPLETE DATA

the information readily available in a large city school district computer files. It is likely that students who are at risk but do not drop out also could benefit from dropout prevention programs. (A potentially valuable study that needs to be done is to compare those at risk for dropping out who stay in school with those who leave in an attempt to identify influences that keep one group in school but not the other.) A review of the literature indicates that the prediction could be improved if other variables such as economic need, the presence of a father in the home, and the schooling history of other members of the family could be included in the analyses. One might argue that school personnel who are more familiar with the students could do as good or better job than a central analysis. That may be true for most students. However, the central analysis has the advantage of complete coverage. School personnel may overlook many students who quietly blend into the work than leave when they get far behind.

The **second implication** is that **dropout prevention programs need not be culturally specific** in their content. That is, there do not seem to be any ethnic-specific characteristics of Black and Hispanic students which operate to increase dropout rates independent of academic accomplishment. Improvement of academic accomplishment as reflected by GPA and grade for age would appear to be the most important target for dropout prevention. Addressing ethnic-specific characteristic may be important in that effort, however.

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